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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/809,974	03/26/2004	Shang-Chih Chen	67,200-1258	7904

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EXAMINER
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QUACH, TUAN N

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 06/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/809,974	<b>Applicant(s)</b> CHEN ET AL	
	<b>Examiner</b> Tuan Quach	<b>Art Unit</b> 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 22-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 22-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.


**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

  
Tuan Quach  
Primary Examiner

**Attachment(s)**

- |   |  |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____  |

### DETAILED ACTION

In view of the Pre Appeal Decision mailed April 11, 2006, the finality of the Office action mailed October 20, 2005 is withdrawn and new rejections follow.

For convenience referencing, "et al." are omitted, e.g., Li for Li et al.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

Art Unit: 2826

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 22-29, 31-35, 39-42 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Li or Chen.

Re claim 22 and 42, Li (2005/0202659 ) teach a gate structure comprising a high k dielectric layer 56 disposed over semiconductor substrate 42, a buffer dielectric layer 58 on the high k dielectric layer 56, a gate electrode layer 60 on the buffer dielectric layer 58. See Figs. 1 and 12, [0027]-[0031]. Chen 2005/0269651 also teaches high K dielectric 32 over semiconductor substrate 31, buffer dielectric 33/34 on the high K dielectric layer, including metal, silicon or nitrogen dopant. See [0014]-[0084], Figs. 2 and 3. The use of interfacial layer is also taught. [0080]. Note that re claim 25 and 42, the material of the buffer dielectric layer comprising dopants selected from the group consisting of a metal, a semiconductor, and nitrogen, such is met by materials for the buffer dielectric disclosed in Li, e.g., [0030], including various nitrogen compounds such as SiN, AlN, etc, and in Chen above, including [0084]. Re claims 23-24, as well as the preamble of claim 22, 41, 42, the voltage threshold being reduced would follow given the same materials of buffer dielectric is taught by Li or Chen; additionally, while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. In re Schreiber, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997) (The absence of a disclosure in a prior art reference relating to function did not defeat the Board's finding of anticipation of claimed apparatus because

Art Unit: 2826

the limitations at issue were found to be inherent in the prior art reference); see also *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 228-29 (CCPA 1971); *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). “[A]pparatus claims cover what a device is, not what a device does.” *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis in original). A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Re claim 25, the inclusion of an interfacial dielectric is also taught in Li, layer 54, [0028], in Chen [0084]. Re claim 26, the various silicon oxide/nitride for the interfacial materials is also taught in Li [0028] and Chen above; additionally, the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials. Re claim 27, the buffer dielectric being greater than 3.9 would be met given the materials disclosed above, e.g., SiN, AlN in Li and corresponding materials in Chen which has dielectric constant greater than that of silicon oxide. The various silicon materials in claims 28, 29 are taught in Li [0030] and in Chen above. Re claims 31 and 32, the dielectric including oxides or nitrides, is also met, e.g., aluminum nitrides as taught above. Re claims 34, 35, the metal dopant of Al is taught in Li above; the enumeration of various alternative and suitable materials would have been conventional

Art Unit: 2826

and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Re claims 39 and 40, the high k dielectric materials being enumerated are also taught in Li, [0029] and Chen above. In any event, the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Claim 30 rejected under 35 U.S.C. 103(a) as being unpatentable over Li or Chen as applied to claims 22-29, 31-34, 39-42 above, and further in view of Adetutu.

Adetutu 2005/0085092 teach concentration gradient in the dielectric layer to prevent unwanted diffusion. See abstract, [0013]-[0033].

It would have been obvious to one skilled in the art to have employed the suitable concentration gradient wherein such is conventional and advantageous to prevent unwanted diffusion as taught by Adetutu.

Claims 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li or Chen as applied to claims 22-29, 31-34, 39-42 above, and further in view of Kim and Xiang.

The reference as applied above does not recite PMOS and NMOS, e.g., in CMOS devices.

Art Unit: 2826

Kim 6,727,130 teaches dielectric materials including  $\text{Al}_2\text{O}_3$ ,  $\text{HfO}_2$  employed in gate insulating layer for formation of PMOS and NMOS device. See column 56 line 62 to column 6 line 18.

Xiang 6,734,527 also teaches CMOS devices including gate materials such as hafnium silicates, aluminum oxide and their applications in MOS devices including NMOS and PMOS devices. See column 4 line 7 to column 6 line 37.

It would have been obvious to one skilled in the art in practicing the above invention to have employed the respective and suitable materials including hafnium oxide and aluminum oxide in NMOS and PMOS devices since such application is conventional and advantageous as evidenced by Kim and Xiang wherein desired dielectric constant for the particular devices can be obtained.

Claims 22-24, 27-29, 31-32, 34, 35, 36, 39, 40, 42 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Bojarczuk.

Re claims 22 and 42, Bojarczuk (2002/0190302) teaches a gate structure comprising a high-k gate dielectric layer 220 disposed over a semiconductor substrate 210; a diffusion barrier 230 (corresponding to applicant's buffer dielectric layer comprising dopants selected from group consisting of metal, semiconductor, and nitrogen) on the high k gate dielectric layer; and a gate electrode layer 240 on the buffer dielectric layer. The claimed material of the buffer dielectric is met, given the materials taught for layer 230, including nitride compounds such as aluminum nitride and silicon nitride. See [0029]-[0042]. Re the recited reduced voltage, e.g., claims 23, 24, 42, etc.,

Art Unit: 2826

the reduced voltage would result, absent evidence to the contrary, as the buffer dielectric or diffusion barrier 230 is present. Such functional language would be deemed to be unpatentable as delineated above wherein the structural limitations are met. Re claim 27, the buffer dielectric constant being greater than 3.9 would be met given the materials such as aluminum nitride and silicon nitride are taught. Re claim 28, the buffer dielectric comprising non-metal containing dielectric selected from the group consisting of metal oxide, semiconductor nitride, oxides, nitrides, and silicates, is met given the teachings of Bojarczuk, [0038], wherein materials such as silicon oxynitride, silicon nitride, aluminum nitrides, are taught. Re claim 29, wherein buffer dielectric layer comprising nitrogen doped dielectric selected from the group consisting of silicon nitrides, silicon oxynitrides, silicate nitrides, silicate oxynitrides, is met over the teachings of Bojarczuk as delineated above re claim 28. Re claims 31, 32, 34, 35, 39, 40, wherein the buffer dielectric comprising a dielectric including metal dopants is met over the teachings of Bojarczuk, [0038] wherein metal dopant such as aluminum is taught. In any event, the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Claims 25, 26, 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Green.

Although Bojarczuk does not explicitly recite the use of interfacial layer under the high k dielectric in these claims, Green 2005/0042846 A1 teaches the use of an



interfacial layer under the high k dielectric layer to facilitate the growth of the high k dielectric and to provide good electrical interface and low interfacial state density. See Fig. 2B, [0006], [0010].

It would have been obvious to one skilled in the art in practicing the above invention to have included the interfacial layer since such is conventional and advantageous as evidenced by Green. The selection of well known interfacial materials in claim 26 for such purpose is conventional and well within the purview of one skilled in the art and as such would have been obvious. Alternatively, official notice is given regarding the use of such conventional alternative materials for the interfacial layer.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Adetutu.

Adetutu 2005/0085092 teach concentration gradient in the dielectric layer to prevent unwanted diffusion. See abstract, [0013]-[0033].

It would have been obvious to one skilled in the art to have employed the suitable concentration gradient wherein such is conventional and advantageous to prevent unwanted diffusion as taught by Adetutu.

Claims 31-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Paton and Chen.

Regarding the alternative of various metal dopants, in addition to the teachings of Bajarczuk delineated above, such would have been obvious given the teachings of Paton, column 10 line 1 et seq. and Chen as delineated above, see [0014]-[0084], Figs. 2 and 3. Additionally, the enumeration of various alternative and suitable materials

Art Unit: 2826

would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Claims 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Kim and Xiang.

The reference as applied above does not recite PMOS and NMOS, e.g., in CMOS devices.

Kim 6,727,130 teach dielectric materials including Al<sub>2</sub>O<sub>3</sub>, HfO<sub>2</sub> employed in gate insulating layer for formation of PMOS and NMOS device. See column 56 line 62 to column 6 line 18.

Xiang 6,734,527 also teaches CMOS devices including gate materials such as hafnium silicates, aluminum oxide and their applications in MOS devices including NMOS and PMOS devices. See column 4 line 7 to column 6 line 37.

It would have been obvious to one skilled in the art in practicing the above invention to have employed the respective and suitable materials including hafnium oxide and aluminum oxide in NMOS and PMOS devices since such application is conventional and advantageous as evidenced by Kim and Xiang wherein desired dielectric constant for the particular devices can be obtained.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Tuan Quach whose telephone number is 571-272-1717. The examiner can normally be reached on M-F from 8:30 AM to 4:30 PM.

Art Unit: 2826

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Nathan Flynn, can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



**Tuan Quach**  
**Primary Examiner**